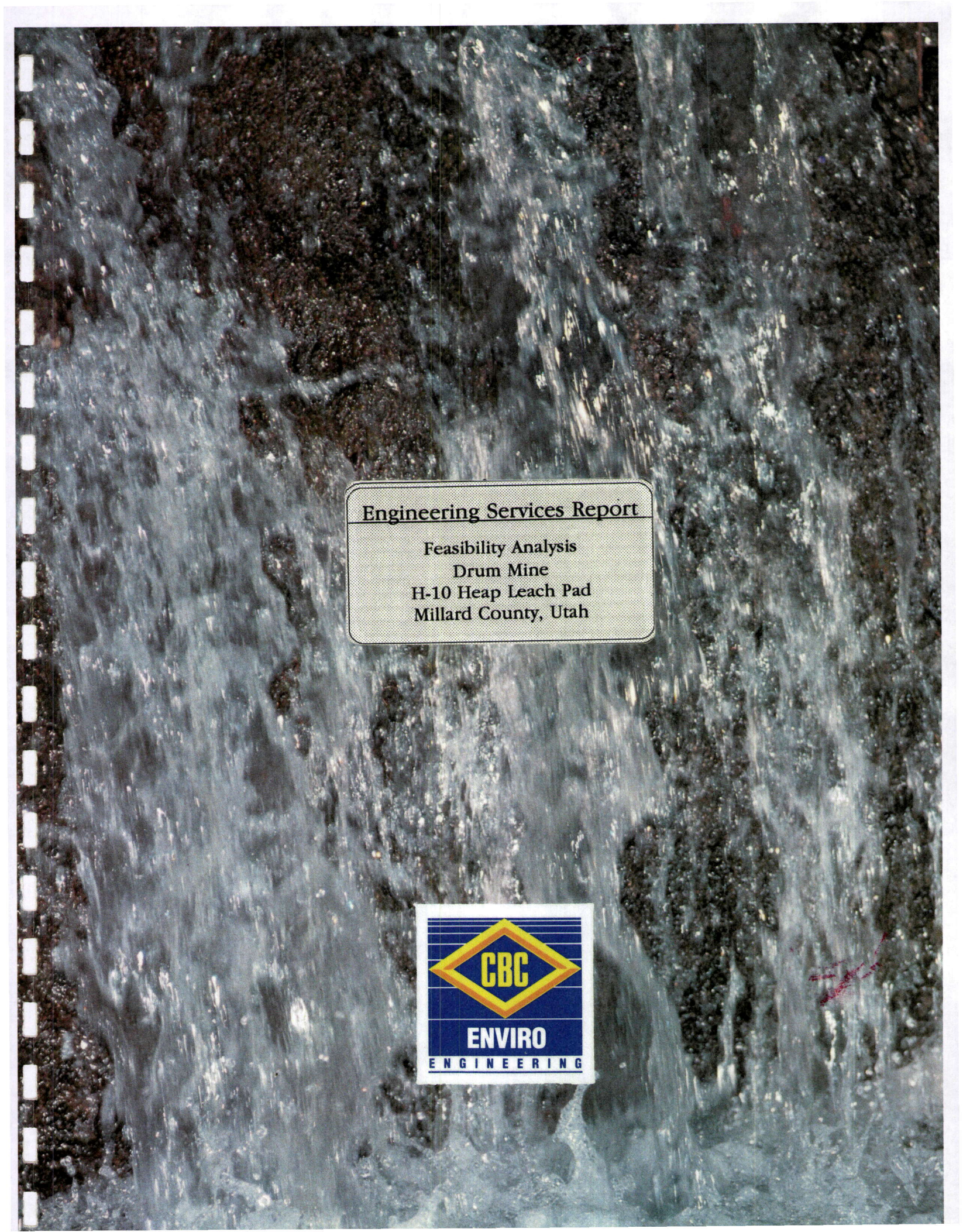

Engineering Services Report

Feasibility Analysis
Drum Mine
H-10 Heap Leach Pad
Millard County, Utah

CBC
ENVIRO
ENGINEERING

June 12, 1991

Jumbo Mining Company
6305 Fern Spring Cove
Austin, Texas 78730

Attention: Dave Hartshorn

Subject: Drum Mine Project
Proposed H-10 Heap Leach Pad
Feasibility Analysis

Dear Mr. Hartshorn:

CBC is pleased to provide you with an engineering feasibility analysis of the H-10 heap leach pad project at the Drum Mine property in Millard County, Utah, pursuant to our proposal dated February 25, 1991. As a result of this analysis, we have developed a draft design approach for review by the Utah Division of Environmental Health (UDEH). Upon approval of the design approach by UDEH, we can proceed with the development of formal plans and specifications for the project.

We appreciate the opportunity to be of service to you in performing this analysis, and would be pleased to answer any questions regarding the investigation or our findings. Our services consist of professional opinions and recommendations made in accordance with generally-accepted engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

Respectfully submitted,

CBC Enviro Engineering

Reviewed by,

Darwin Christensen, P. E.
Civil Engineer

Jerry Riding
Manager

P.O. Box 30777,
4446 W. 1730 S. SLC, UT 84130
(801) 974-5544 FAX 801-972-6769
TOLL FREE 1-800-453-8418

Engineering Feasibility Analysis

Drum Mine

H-10 Heap Leach Pad

Millard County, Utah

Prepared for

Jumbo Mining Company

June 12, 1991

CEE Job No. 45-0320-38

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1.0 Introduction

1.1 Purpose and Scope

As stated in our proposal dated February 25, 1991, the purpose of our investigation has been to develop an information base pursuant to the first requirement stated in the submittal review letter dated September 7, 1990, addressed to Jumbo Mining Company from the Utah Division of Environmental Health. This requirement is that plans, specifications, and construction certification be submitted bearing the seal of a registered professional engineer. Points to be addressed include those indicated as items I through VI on the second page of the submittal review letter. We have adopted a three phase approach to developing the submission. During this first phase, we have developed a draft design approach for initial review by the Division of Environmental Health. Our approach is supported by the testing of underlying soils and fill materials scheduled for use in the structure, by hydrologic data, and by review of approved heap leach designs and discussion with State officials. A detailed description of services for this phase of the project is as follows:

1. Review engineering drawings, topographic maps, and pertinent correspondence prepared by Jumbo Mining Company and submitted to the Division of Environmental Health.

2. Inspect the proposed new heap leach pad site with regard to development of a sampling plan for underlying soils and proposed fill materials, and development of the required hydrologic and other associated parameters.

3. Sample underlying soils and proposed fill materials, and test these for soil type, consolidation, and permeability. Determine an appropriate slope for the heap to prevent sloughing of ore materials.

4. Determine the hydrologic and hydraulic discharge for the 100-year rainstorm of 24-hour duration, and the associated storage volume required.

5. Prepare initial draft design for heap leach pad in accordance with generally-accepted standards, giving special attention to points I through VI on page 2 of the above-referenced submittal review letter. The draft design and associated feasibility report will be reviewed and signed by a registered professional engineer, and will be affixed with the engineer's seal. The feasibility assessment has been performed in accordance with criteria found in Paragraph 13.2.a, Utah Department of Health, Division of Environmental Health Standards for Extraction of Metals by Heap Leaching, 1990 Edition.

6. Meet with Jumbo Mining Company representatives and with Division of Environmental Health personnel, if requested, to discuss recommended design of the new heap leach pad (H-10 site), and findings of the feasibility study.

Upon acceptance of the design, including any required modifications or additions to the draft, we will be in a position to prepare formal plans and specifications bearing the seal of the engineer (second project phase), and to certify construction of the structure (third project phase).

The scope of this investigation has been limited to providing documentation of the subject assessment of feasibility for an additional heap leach pad at the Drum Mine site as set forth in the subparagraphs of Paragraph 13.2.a, Utah Department of Health, Division of Environmental Health Standards for Extraction of Metals by Heap Leaching, 1990 Edition. Subsequent remedial improvements, enhancements, and requisite additional process equipment and piping for the handling of leach liquors beyond the perimeter of the proposed leach pad and containment dikes are not a part of the scope of this project.

1.2 Site Description

The investigation site is the proposed location of the H-10 heap leach pad covering 12 acres at the Drum Mine, in Millard County, Utah. The H-10 site is located in the SE 1/4 of the NW 1/4 of section 7, T 15 S, R 10 W, SLBM. The Drum Mine is operated by Jumbo Mining Company with headquarters in Austin, Texas. Figure 1-1 is a 1:24,000-scale map showing the Drum Mine and near vicinity, with the H-10 leach pad site noted.

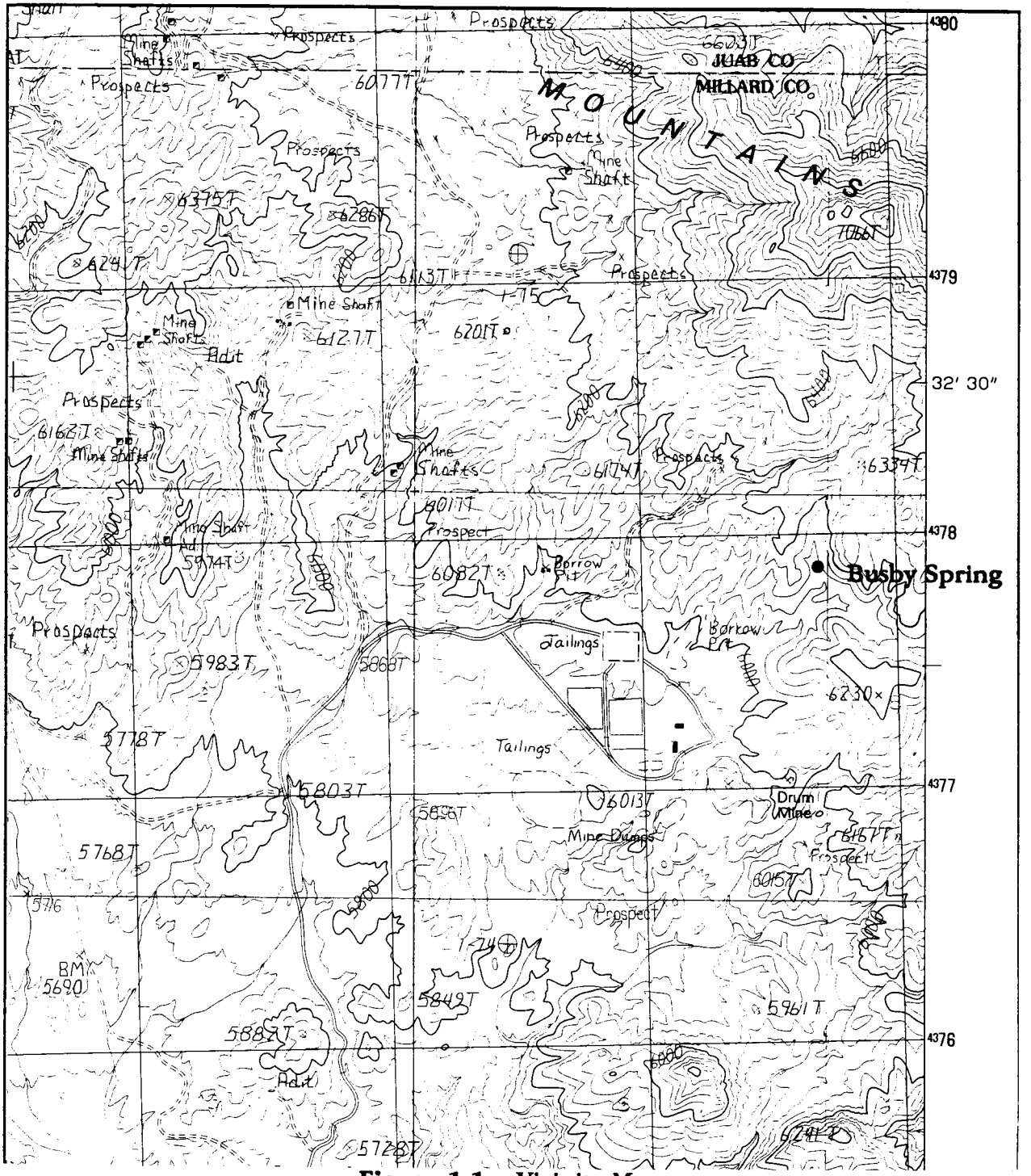


Figure 1-1 -- Vicinity Map

2.0 Site Investigation

CBC Enviro Engineering personnel performed site investigations and sampling of subsurface soils on March 14 and 21, 1991. During the initial site visit, the project manager and engineer developed a sampling plan for the H-10 site and the nearby borrow source for clay fill material. Senior Technician R. M. Chapman carried out the sampling plan on March 21, 1991. Excavating equipment and operator were provided by the Drum Mine. A total of 25 soil test pits were dug at the H-10 site and borrow source area, including 4 test pits at the borrow source area and 21 test pits at the H-10 site. The locations and numbering of the test pits are shown in Figure 2-1, a plan map of the site drawn at 1:2,400 scale.

The soil sampling protocol developed for the project included the following procedures:

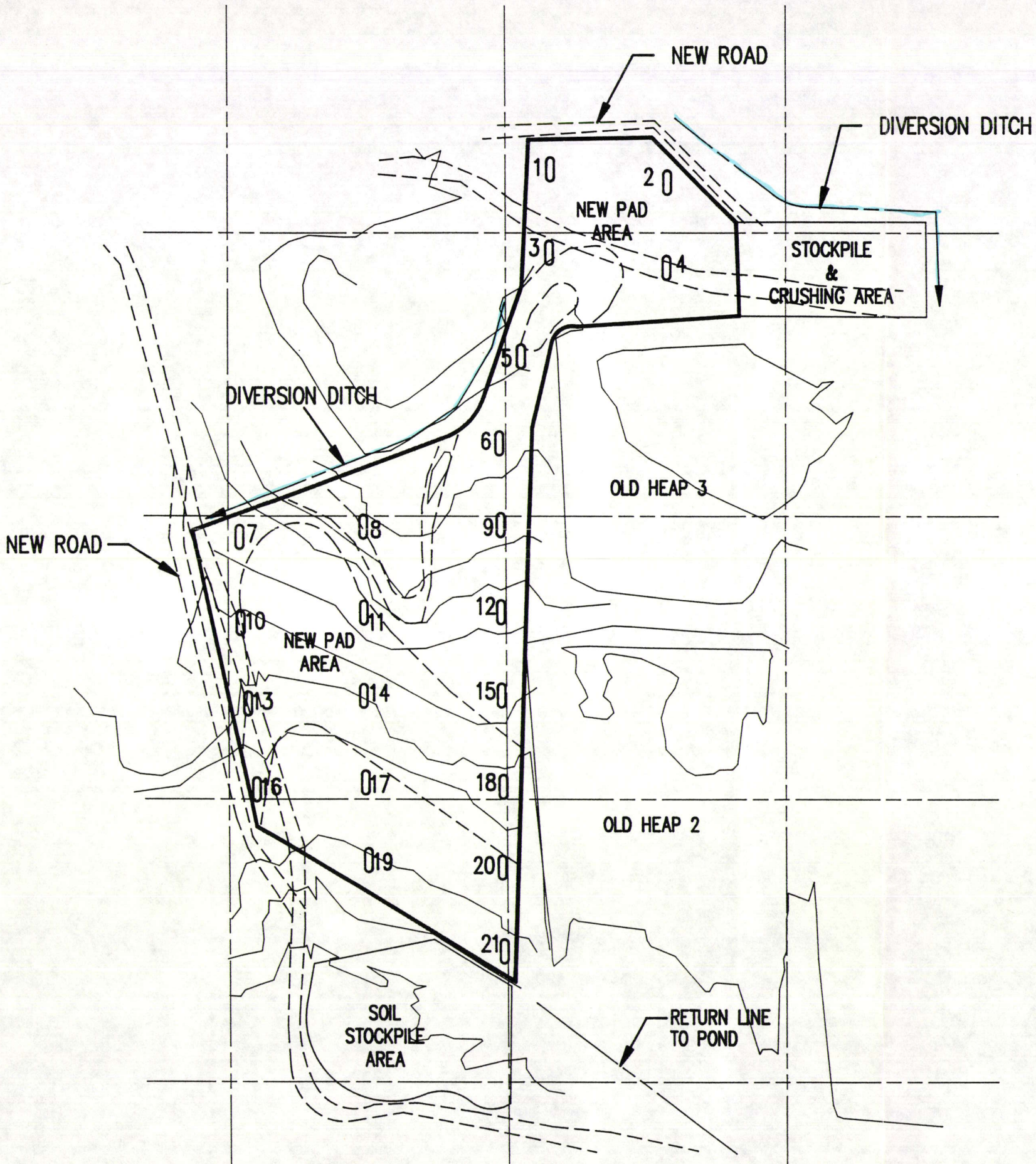
- Determine the thickness of soil to be removed at the sample location (based on an isopach map of the thickness of soil scheduled for removal across the H-10 pad site; the isopach map was prepared by Jumbo Mining Company and is included as Figure 2-2).
- If the residual soil at the location, after removal of the indicated amount, will exceed 6 inches, then obtain samples of the soil that will remain.
- Obtain horizontal drive samples where possible, especially in the south part of the H-10 pad area.
- If the residual soil thickness is sufficient to allow, obtain samples at depths of 2 and 5 feet below the level of soil to be removed; otherwise, split the residual soil zone and sample the midpoint.
- At the soil borrow area, obtain horizontal or vertical drive samples at 2 and 5 feet at all locations.

Logs of materials encountered in each of the soil test pits are included in Appendix A.

Soil samples obtained in accordance with the protocol described above are listed in Table 2-I, below.

Table 2-I – Soil Samples at the H-10 Pad and Borrow Areas		
Location	**Depth (feet)**	**Sample Type**
TP-1 through TP-4 (H-10 site)	Bedrock encountered, no samples obtained	
TP-5 (H-10 site)	0.2 to 1.0	Grab sample
TP-6 (H-10 site)	Re-worked imported material, no samples obtained	
TP-7 (H-10 site)	Bedrock encountered, no samples obtained	
TP-8 (H-10 site)	Bedrock encountered, no samples obtained	
TP-9 (H-10 site)	Re-worked imported material, no samples obtained	
TP-10 (H-10 site)	Bedrock encountered, no samples obtained	
TP-11 (H-10 site)	Bedrock encountered, no samples obtained	
TP-12 (H-10 site)	0.2 to 1.5	Grab sample
TP-12 (H-10 site)	1.0	Drive sample
TP-13 (H-10 site)	Bedrock encountered, no samples obtained	
TP-14 (H-10 site)	1.5 to 3.0	Grab sample
TP-14 (H-10 site)	2.0	Drive sample
TP-15 (H-10 site)	1.0 to 3.5	Grab sample
TP-15 (H-10 site)	1.5	Drive sample
TP-16 (H-10 site)	1.0 to 3.0	Grab sample
TP-16 (H-10 site)	2.0	Drive sample
TP-17 (H-10 site)	Bedrock encountered, no samples obtained	
TP-18 (H-10 site)	0.5 to 2.0	Grab sample
TP-18 (H-10 site)	1.5	Drive sample

TP-19 (H-10 site)	Bedrock encountered, no samples obtained	
TP-20 (H-10 site)	1.5 to 3.0	Grab sample
TP-20 (H-10 site)	3.0	Drive sample
TP-21 (H-10 site)	3.0 to 4.0	Grab sample
TP-21 (H-10 site)	3.0	Drive sample
CBTP-1 (borrow area)	2.0	Drive and grab samples
CBTP-1 (borrow area)	5.0	Drive and grab samples
CBTP-2 (borrow area)	2.0	Drive and grab samples
CBTP-2 (borrow area)	5.0	Drive and grab samples
CBTP-3 (borrow area)	2.0	Drive and grab samples
CBTP-3 (borrow area)	5.0	Drive and grab samples
CBTP-4 (borrow area)	2.5	Drive and grab samples
CBTP-4 (borrow area)	5.0	Drive and grab samples



— SHOWS SOIL TEST PITS

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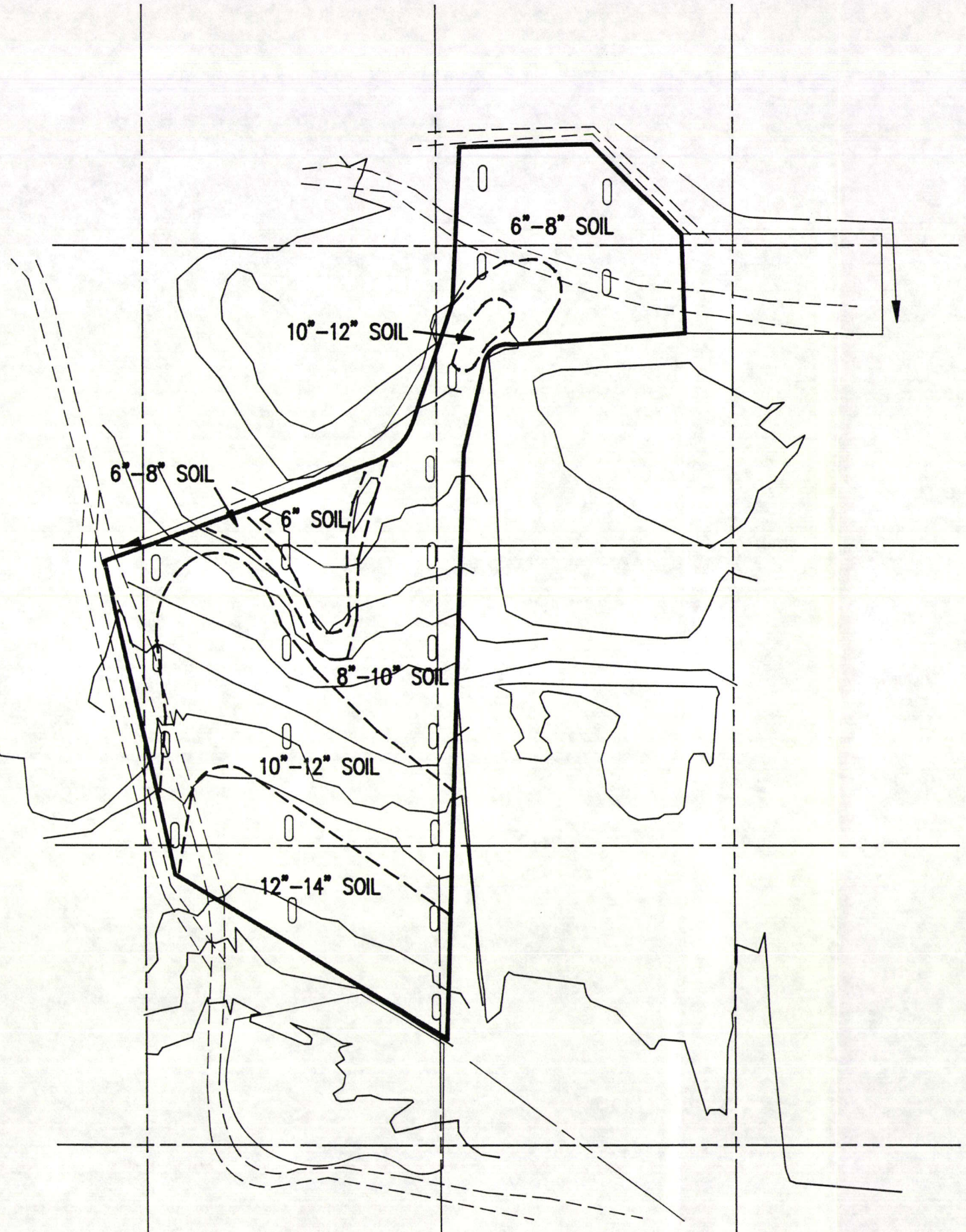
DIMENSIONS ARE IN FEET
TOLERANCES
DECIMALS .XX ± .05 .XXX ± .010
ANGULAR ± 0.5°

DRAWN D. Riding	DATE 6/12/91	CBC ENVIRO ENGINEERING	CBC Enviro Engineering®
CHECKED			SITE MAP
DESIGN		SIZE B	FSCM NO.
		DWG NO. FIGURE 2-1	REV 1
		SCALE 1:2,400	SHEET 1 OF 1



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CBC ENVIRO ENGINEERING

CBC Enviro Engineering®

ISOPACH MAP OF SOIL
THICKNESS TO BE REMOVED

SIZE	FSCM NO.	DWG NO.	REV
B		FIGURE 2-2	1

SCALE 1:2,400 SHEET 1 OF 1

3.0 Laboratory Testing

3.1 Test Matrix

Selected soil samples were tested for engineering properties in order to determine the load-bearing capacity of the subsurface soil at the H-10 pad site, and to determine the permeability and bearing capacity of the proposed borrow materials. The soil sample test matrix is shown in Table 3-I, below.

Table 3-I -- Soil Sample Test Matrix and Results

Location	Depth (feet)	Laboratory Test	Results
TP-14 (H-10 site)	2.0	Consolidation	0.65 %
TP-15 (H-10 site)	1.5	Consolidation	2 %
TP-16 (H-10 site)	2.0	Consolidation	5.5 %
TP-18 (H-10 site)	1.5	Consolidation	5 %
TP-20 (H-10 site)	3.0	Consolidation	8 %
TP-21 (H-10 site)	3.0	Consolidation	2 %
CBTP-1 (borrow area)	2.0	Permeability	3×10^{-8} cm/s (preliminary)
CBTP-1 (borrow area)	2.0	Consolidation	1 %
CBTP-4 (borrow area)	2.5	Permeability	1×10^{-7} cm/s (preliminary)
CBTP-4 (borrow area)	2.5	Consolidation	2 %

~0.63
~2.2%
~5.6%
~4.5%
~8.3%
~1.5%

3.2 Results

Laboratory testing of the soil samples included consolidation and permeability tests, as shown in Table 3-I, above. Consolidation testing involves subjecting an undisturbed or remolded soil sample to loading comparable to expected structural loads. Sample strain that occurs under the loaded condition is reported as percent linear deformation. Permeability testing (triaxial procedure) involves loading a saturated soil sample with differential pressure to induce measurable fluid (water) flow through the sample matrix. The one-dimensional, longitudinal flow rate through the sample is reported as centimeters per second. Laboratory test reports are included in Appendix B. Testing was performed by Chen-Northern, Inc.

Laboratory test loads were selected on the basis that the H-10 heap leach pad will be constructed to a height of 40 feet in 10- to 15-foot lifts. The tonnage factor for ore materials is 20½ cubic feet per ton, and the unit weight of ore materials is 98 pounds per cubic foot. As shown in Table 3-I, consolidation tests performed on the drive samples recovered from the H-10 heap leach pad site indicate strains of 0.7 to 6.0 percent at unit pressures equivalent to anticipated field loading conditions. Anticipated soil settlements calculated from the measured sample strain deformations are expected to be in the range of ½ to 3 inches, varying with the depth of soil across the H-10 pad site. An isopach map of soil thickness as observed in the test pits at the H-10 site has been prepared as Figure 3-1. This soil thickness isopach map shows no abrupt discontinuities in the pattern of soil thickness across the site. The absence of discontinuities in the distribution of soil thickness beneath the site indicates that abrupt differential settlements, which could threaten the integrity of the liner, are not expected.

The side-slope grades of the proposed H-10 leach pad ore lifts will be maintained between 3H:1V and 2H:1V. The critical side-slope grade of the ore material has been determined to be between 0.5H:1V and 0.6H:1V. Should maximum settlements occur, the ore heap side slopes will not be affected significantly, and slope instability is not

expected.

Triaxial permeability tests are ongoing for two soil samples from the proposed clay borrow area. Neither sample has stabilized yet over the course of a test period exceeding 1½ months in duration. The samples appear to be bentonitic clay, and preliminary reports indicate permeability of the samples to be in the range of 10^{-8} to 10^{-7} centimeters per second.

4.0 Hydrologic Analysis

Figure 1-1 shows the Drum Mine and nearby vicinity at a scale of 1:24,000. This vicinity map was adapted from the Lady Laird Peak U. S. Geological Survey 7.5' quadrangle topographic map, and shows the locations of nearby hydrologic features. Observations concerning hydrologic features near the site are as follows:

- With the exception of Busby Spring, no wells or springs used for stock watering or irrigation are located within a one-mile radius of the H-10 pad site. Water from Busby Spring has excessive nitrate content, and is considered to be Class III water.
- No wetlands are located within a one-mile radius of the site.
- Surface waters found within a one-mile radius of the site occur in response to orographic precipitation and snow melt runoff. Projected runoff from the proposed heap leach pad is examined below in detail.
- The Drum Mine is located in a remote desert and mountainous area, and no agricultural improvements requiring irrigation ditches are found within a one-mile radius of the site.
- The Drum Mine process water supply source is located approximately six miles distant from the project site. Water containing the leach agent will be applied by sprinklers placed on 20-foot grid centers. Each sprinkler will discharge solution at a rate of 2.0 gallons per minute (gpm), so that the overall application rate of the solution will be 220 gpm per acre, or 3.8 million gallons per day over the 12-acre H-10 pad site.
- The Drum Mine uses the same water supply source, located approximately six miles distant from the project site, for both process and drinking water. This water supply source is for private consumption by the Drum Mine, and is not intended for public distribution.

The Drum Mine facilities are distant from any major drainage canals, rivers, or streams, and are situated outside any identifiable flood plains. Consequently, the risk of flooding is considered to be low for all of the following:

- Public roads located within a one-mile radius of the H-10 pad site, and private service roads maintained by the Drum Mine. These are situated mostly along sidehills and on higher ground. Consequently, loss of access due to flooding could occur only under very severe flash-flood conditions.

- Buildings and structures at the Drum Mine site. These are located at relatively higher elevations than the surrounding terrain, and would not be threatened by flooding due to short duration, high intensity precipitation runoff.

For the past 50 to 75 years, the overwhelming majority of storm water control facilities have been designed based on what is termed the "rational method" (U. S. Department of Transportation, 1979) to express the relationship between rainfall and runoff. Runoff rates predicted by use of the rational method have been found to be satisfactory for relatively small areas. In evaluating storm water detention requirements to achieve compliance with Division of Environmental Health standards at the Drum Mine, the runoff rate for the 100-year, 24-hour storm event at the H-10 pad site has been determined according to the rational method.

The rational method runoff rate was calculated with the aid of the HYDRO portion of HYDRAIN, a Hydrologic and Hydraulic design computer software package developed by GKY Associates, Springfield, Virginia. HYDRO was used to calculate site specific rainfall intensities from values in a unique database. This database consists of 1-hour duration rainfall for 2- and 100-year return periods at 5,597 latitude/longitude coordinate pairs. The database was developed from data compiled in the National Weather Service (NWS) technical memorandum HYDRO-35, and the National Oceanic and Atmospheric Administration (NOAA) Atlas 2. The resolution of the data is as follows: 30 minutes for the eastern and midwestern states covered by the HYDRO-35 document, 20 minutes for the eleven western states covered by the NOAA Atlas 2, and 10 minutes for parts of southern California.

The manner in which HYDRO calculates a rainfall intensity is by weighted average of rainfall intensities at points surrounding a latitude/longitude coordinate pair. A rainfall

$(12\ \text{ACRE})(43{,}560\ \text{FT}^3/\text{ACRE})(1.5\ \text{FT})(7.48\ \text{GAL}/\text{FT}^3) = 5{,}864{,}918\ \text{GAL}$

5.8 MILLION GAL (NO FREEBOARD)

W/8" FREEBOARD $\Rightarrow$ (0.83FT) $\Rightarrow$ 3.2 MILLION GAL

4.4 MILLION GAL $\Rightarrow$ 1.12 FT HEIGHT OF FLUIDS WITH .38FT (4.6") OF FREEBOARD

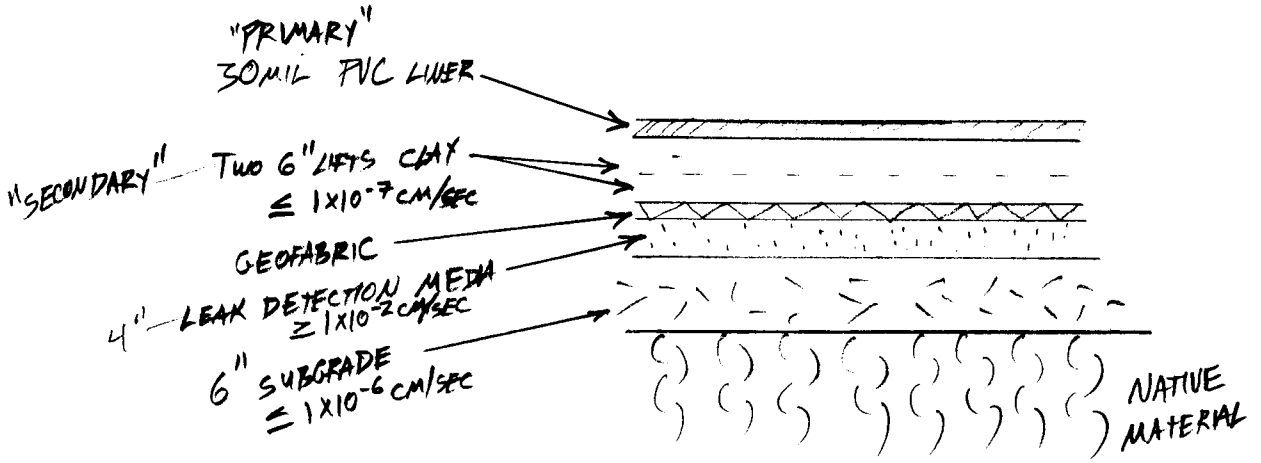
intensity is calculated for a desired event frequency and duration using two steps. In the first step, the rainfall is adjusted to the event frequency or return period using NWS regression equations. This yields a 1-hour rainfall corresponding to the desired frequency. The second step adjusts the duration of the storm event. HYDRO assumes the storm duration is equal to the time of concentration of the watershed in question. The methods for determining time of concentration are:

- Soil Conservation Service (SCS) curve number, or the kinematic wave for overland time of concentration
- SCS grassy waterway, Manning's formula, or the Federal Highway Administration Hydraulic Engineering Circular 12 triangular gutter for channel time of concentration
- User-supplied for combined time of concentration

Finally, the 1-hour rainfall intensity is adjusted to a rainfall intensity appropriate for the desired duration using NWS and GKY regression equations. In this manner, any rainfall with an event frequency between 2- and 100-years and duration between 5 minutes and 24 hours can be considered for analysis. Use of the HYDRO-35 and Atlas 2 documents is not required, because the intensity calculated by HYDRO represents the data used to create these documents.

Using this approach, the estimated runoff from the H-10 heap leach pad is 0.6 million gallons per day for the 100-year event frequency and 24-hour rainfall duration. This result is based on a 12-acre pad site, and assumes a rational method "C" value of 0.9. The proposed leach agent application rate is 3.8 million gallons per day, and the sum of the proposed leach agent application rate and the predicted storm water runoff rate is 4.4 million gallons per day. Given a 24-hour duration, 100-year return period storm event, the runoff detention and storage facilities surrounding the proposed H-10 heap leach pad must be designed for a minimum capacity of 4.4 million gallons. The collection berm around the perimeter of the leach pad site will have a nominal height of 1.5 feet in order to provide the required storage.

MINIMUM?


"PRIMARY"
30 MIL PVC LINER
"SECONDARY"
TWO 6" LIFTS CLAY
≤ 1x10⁻⁷ CM/SEC
GEOFABRIC
4" LEAK DETECTION MEDIA
≥ 1x10⁻² CM/SEC
6" SUBGRADE
≤ 1x10⁻⁶ CM/SEC
NATIVE MATERIAL

5.0 Design Recommendations

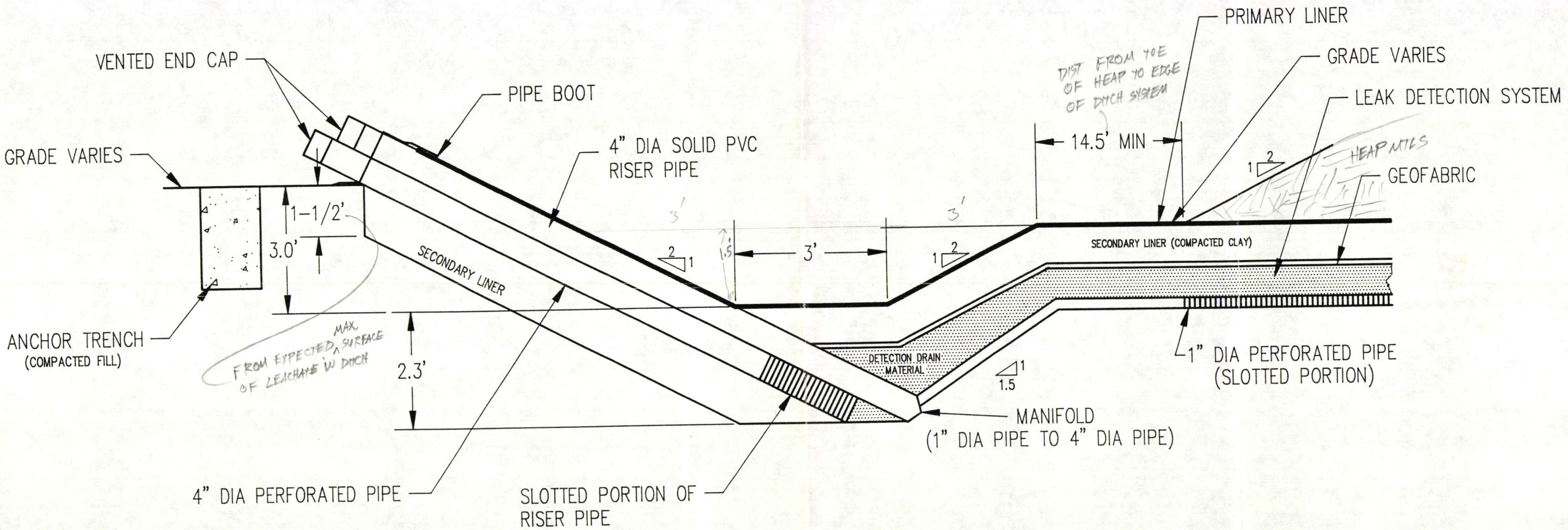
Based on the foregoing engineering analysis, and after discussion with Division of Environmental Health officials, CBC Enviro Engineering has prepared a recommended design approach for liner and head monitoring systems.

The recommended liner design follows the approach previously approved by the Division of Environmental Health, submitted by the North Lily Mining Company of Eureka, Utah. A typical cross section showing the recommended approach to liner construction is shown in Figure 5-1. The liner design approach includes five components, described from top to bottom as follows:

- Primary liner consisting of a 30 mil thickness PVC flexible membrane.
- Two six-inch lifts of compacted clay with permeability of 10^{-7} cm/s or less. The clay samples obtained from the proposed borrow area meet this permeability requirement, and the borrow area clay could be used for this material.
- A geofabric to separate the compacted clay from the underlying leak detection media.
- Four inches of leak detection media with permeability of 10^{-2} cm/s or more. Crushed ore could be used for this material.
- Six inches of subgrade material with permeability of 10^{-6} cm/s or less. Soil underlying the H-10 pad area will not meet this permeability requirement. Clay fill material can be imported from the clay borrow area and placed at the pad site to meet this subgrade requirement.

A cross section of the typical recommended head monitoring system design is also shown in Figure 5-1. CBC Enviro Engineering recommends placing one-inch diameter, slotted PVC pipe at the interface between the subgrade material and the leak detection media beneath the ore heap, to monitor for leach agent loss. The one-inch diameter PVC pipe will manifold to four-inch diameter PVC sump collection pipes, as drawn. A second

four-inch diameter PVC riser will extend into the leak detection media at the toe of the heap, in order to monitor for local leach agent loss through the liner beneath the liquor collection system. Figure 5-2 shows the recommended layout of the smaller, one-inch PVC piping beneath the leach pad, and the manifolding and placement of the four-inch diameter sump collection pipes. We recommend placing the smaller diameter piping on 50-foot centers beneath the pad, and manifolding the small diameter piping to larger diameter sumps approximately every 300 feet around the periphery of the pad.



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DRAWN D. Riding	DATE 6/12/91
CHECKED	
DESIGN	

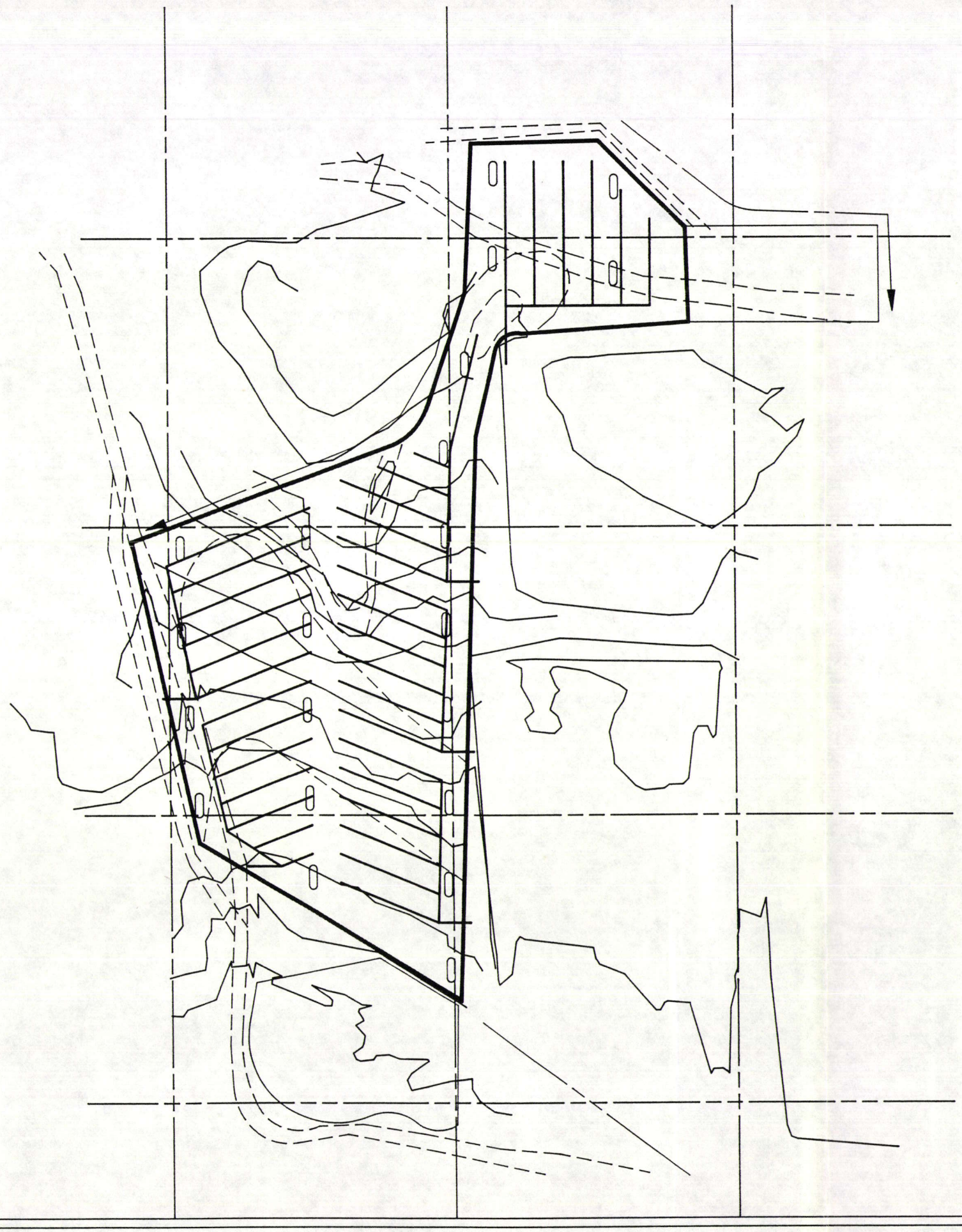
CBC ENVIRO ENGINEERING

CBC Enviro Engineering®

RECOMMENDED LINER AND
HEAD MONITORING SYSTEM DESIGN

SIZE	FSCM NO.	DWG NO.	REV
B		FIGURE 5-1	1

SCALE NTS SHEET 1 OF 1



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ANGULAR ± 0.5°

DRAWN D. Riding	DATE 6/12/91	CBC ENVIRO ENGINEERING
CHECKED		
DESIGN		

CBC Enviro Engineering®

RECOMMENDED LAYOUT OF HEAD MONITORING SYSTEM PIPING

SIZE	FSCM NO.	DWG NO.	REV
B		FIGURE 5-2	1

SCALE 1: 2,400 SHEET 1 OF 1

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. CBTP-1*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at northwest corner of clay borrow area*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; moist, brown, organics present (topsoil)	SP-SM			
	Lean clay with sand and silt; stiff, moist, brown, scattered gravels (3/4" minus)	CL			
1.0	*Fat clay;* stiff, moist, gray with rust-colored oxide stains (probably bentonite)	CH			1.0
2.0				Permeability Consolidation	2.0
3.0					3.0
4.0					4.0
5.0					5.0

Bottom of Test Pit (5.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. CBTP-2*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at northeast corner of clay borrow area*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; dense, moist, brown (topsoil)	SP-SC			
	Lean clay with silt and sand; stiff, moist, brown, scattered gravels (3/4" minus)	CL			
1.0	*Fat clay;* stiff, moist, gray with rust-colored oxide stains (probably bentonite)	CH			1.0
2.0					2.0
3.0					3.0
4.0					4.0
5.0					5.0

Bottom of Test Pit (5.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. CBTP-3*

CEE Job No. 45-0320-38
Completed on 3/21/91 by Drum Mine using a JD 500 backhoe
Logged by R. M. Chapman

Page 1 of 1
Located at southwest corner of clay borrow area
Elevation of ground water: Not encountered

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; dense, moist, brown (topsoil)	SP-SM			
	Poorly graded sand with silt and clay; dense, moist, brown, scattered gravels (1 1/2" minus)	SP-SM			
1.0	*Lean clay;* very stiff (hard), moist, red-brown, breaks up in 4" minus chunks	CL			1.0
2.0					2.0
3.0					3.0
4.0	*Fat clay;* stiff, moist, gray with rust-colored oxide stains (bentonite)	CH			4.0
5.0					5.0

Bottom of Test Pit (5.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. CBTP-4*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at southeast corner of clay borrow area*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; dense, moist, brown (topsoil)	SP-SM			
	Lean clay with silt and sand; stiff, moist, brown	CL			
1.0	*Poorly graded gravel with sand and silt;* dense, moist, brown-gray	GP			1.0
2.0					2.0
	Fat clay; stiff, moist, gray with rust-colored oxide stains (bentonite)	CH		Permeability Consolidation	
3.0					3.0
4.0					4.0
5.0					5.0

Bottom of Test Pit (5.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-1*

CEE Job No. 45-0320-38
Completed on 3/21/91 by Drum Mine using a JD 500 backhoe
Logged by R. M. Chapman

Page 1 of 1
Located at H-10 site as shown on Figure 2-1
Elevation of ground water: Not encountered

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; Medium dense, moist, brown (topsoil)	SP-SM			
	Poorly graded sand with silt; medium dense, moist, brown (weathered bedrock)	SP-SM			
1.0	*Bedrock*				1.0

Bottom of Test Pit (1.0 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-2*

CEE Job No. 45-0320-38

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe

Logged by R. M. Chapman

Located at H-10 site as shown on Figure 2-1

Elevation of ground water: Not encountered

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Sandy gravel; imported material	GP			
	Weathered bedrock; more competent with depth				
1.0	Bottom of Test Pit (1.0 feet)				1.0

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-3*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; medium dense, moist, brown	SP-SM			
1.0	*Bedrock*				1.0

Bottom of Test Pit (1.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-4*

CEE Job No. 45-0320-38

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe

Logged by R. M. Chapman

Located at H-10 site as shown on Figure 2-1

Elevation of ground water: Not encountered

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Sandy gravel; imported material	GP			
	Weathered bedrock; more competent with depth				
1.0					1.0
2.0					2.0
3.0	Bottom of Test Pit (3.0 feet)				3.0

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site *Test Pit No. TP-5*

CEE Job No. 45-0320-38 *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil;	SP-SM			
	Poorly graded sand with silt and clay; dense, moist, brown	SP-SM			
1.0	*Weathered bedrock;* hard				1.0
2.0	Bottom of Test Pit (2.0 feet)				2.0

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Drum Mine H-10 Pad Site — *Test Pit No. TP-6*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Reworked imported material; no test pit required				

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-7*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; soft, moist, brown	SP-SM			
1.0	*Weathered bedrock;* hard				1.0

Bottom of Test Pit (1.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-8*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; loose, moist, brown	SP-SM			
1.0	*Bedrock;* hard				1.0

Bottom of Test Pit (1.0 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-9*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Reworked imported material; no test pit required				

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-10*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; dense, moist, brown	SP-SM			
1.0	*Weathered bedrock;* hard				1.0

Bottom of Test Pit (1.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-11*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; loose, moist, brown	SP-SM			
1.0					1.0
	Weathered bedrock; hard				

Bottom of Test Pit (1.0 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site *Test Pit No. TP-12*

CEE Job No. 45-0320-38 *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
1.0	*Poorly graded sand with clay;* dense, moist, brown	SP-SC			1.0
2.0	*Weathered bedrock;* hard				2.0

Bottom of Test Pit (2.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-13*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; dense, moist, brown	SP-SM			
1.0	*Weathered bedrock;* hard				1.0
2.0	Bottom of Test Pit (2.0 feet)				2.0

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-14*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
1.0	*Poorly graded sand with silt;* dense, moist, brown	SP-SM			1.0
2.0	*Lean clay with silt and fine sand;* dense, dry, light brown-gray	CL		Consolidation	2.0
3.0	*Bedrock;* hard				3.0

Bottom of Test Pit (3.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-15*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
1.0	*Poorly graded sand with clay;* dense, moist, brown	SP-SC		Consolidation	1.0
2.0					2.0
3.0					3.0
4.0	*Weathered bedrock;* hard				4.0

Bottom of Test Pit (4.0 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site *Test Pit No. TP-16*

CEE Job No. 45-0320-38 *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe *Located at H-10 site as shwon on Figure 2-1*

Logged by R. M. Chapman *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt and clay; dense, moist, brown	SP-SM			
1.0	*Lean clay with silt and fine sand;* stiff, dry, light brown	CL		Consolidation	1.0
2.0					2.0
3.0	*Weathered bedrock;* hard				3.0
4.0	Bottom of Test Pit (4.0 feet)				4.0

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-17*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt	SP-SM			
1.0					1.0
	Bedrock; hard				

Bottom of Test Pit (1.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-18*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
1.0	*Poorly graded sand with silt and clay;* dense, moist, brown	SP-SM		Consolidation	1.0
2.0	*Weathered bedrock;* hard				2.0

Bottom of Test Pit (2.5 feet)

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site *Test Pit No. TP-19*

CEE Job No. 45-0320-38 *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
	Poorly graded sand with silt; dense, moist, brown	SP-SM			
1.0					1.0
	Weathered bedrock; hard				
2.0	Bottom of Test Pit (2.0 feet)				2.0

CBC ENVIRO ENGINEERING

Drum Mine H-10 Pad Site — *Test Pit No. TP-20*

CEE Job No. 45-0320-38 — *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe — *Located at H-10 site as shown on Figure 2-1*

Logged by R. M. Chapman — *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Topsoil	SP-SM			
1.0	*Poorly graded sand with silt;* dense, moist, brown	SP-SM			1.0
2.0	*Poorly graded sand with clay and silt;* dense, moist, brown	SP-SC		Consolidation	2.0
3.0					3.0
4.0	*Weathered bedrock*				4.0

Bottom of Test Pit (4.5 feet)

CBC ENVIRO ENGINEERING

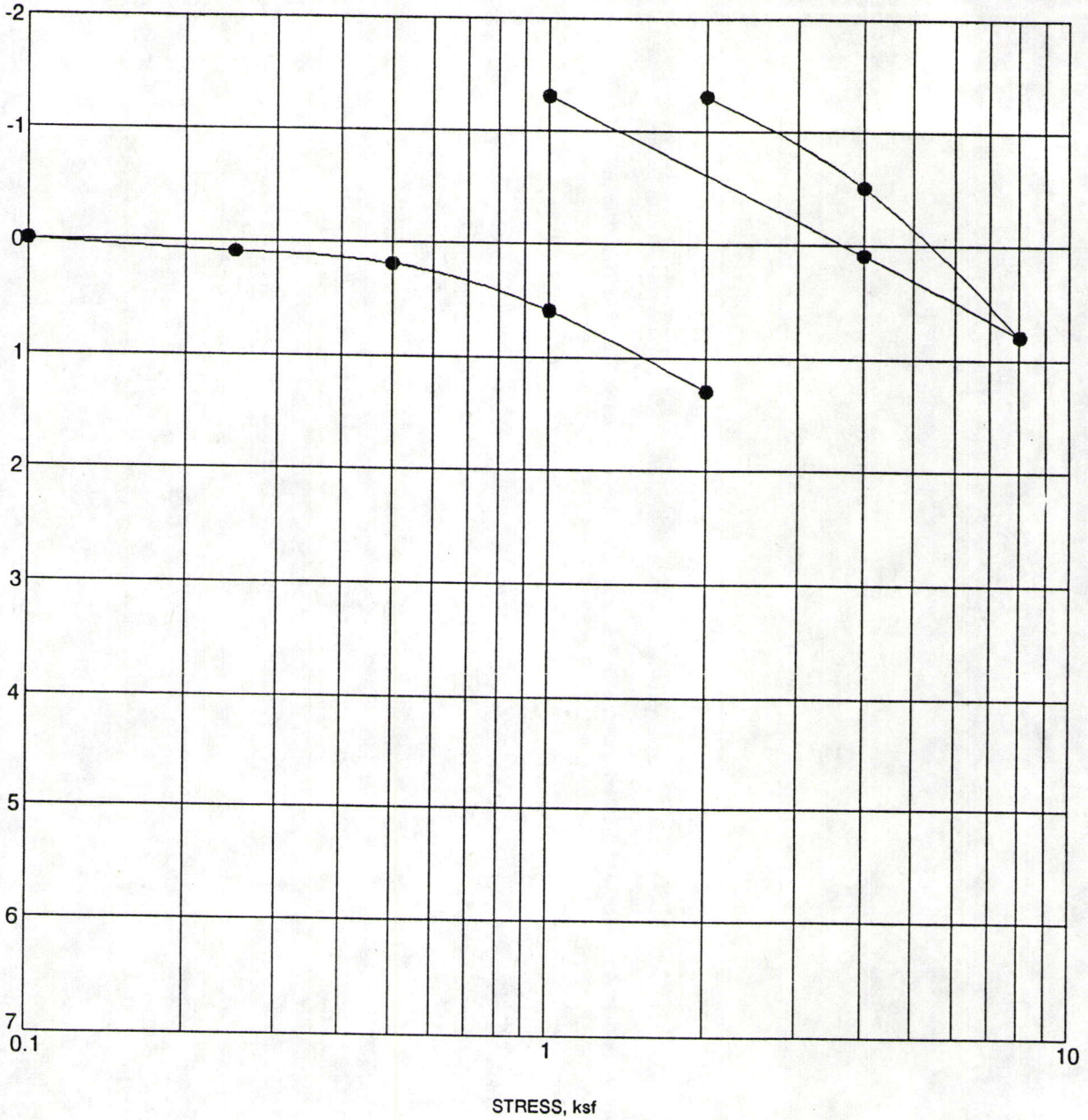
Drum Mine H-10 Pad Site *Test Pit No. TP-21*

CEE Job No. 45-0320-38 *Page 1 of 1*

Completed on 3/21/91 by Drum Mine using a JD 500 backhoe *Located at H-10 as shown on Figure 2-1*

Logged by R. M. Chapman *Elevation of ground water: Not encountered*

Depth (feet)	Description	Symbol	Samples	Laboratory Tests	Depth (feet)
	Poorly graded sand with silt and clay; moist, dark brown organics present (topsoil)	SP-SM			
	Poorly graded sand with silt, clay and gravel; dense, moist, brown	SP-SM			
1.0					1.0
2.0					2.0
3.0				Consolidation	3.0
4.0	*Weathered bedrock*				4.0
5.0	Bottom of Test Pit (5.0 feet)				5.0



Specimen Identification	Classification	DD	MC%
● CBTP-1		91	23

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **7**

CONSOLIDATION TEST

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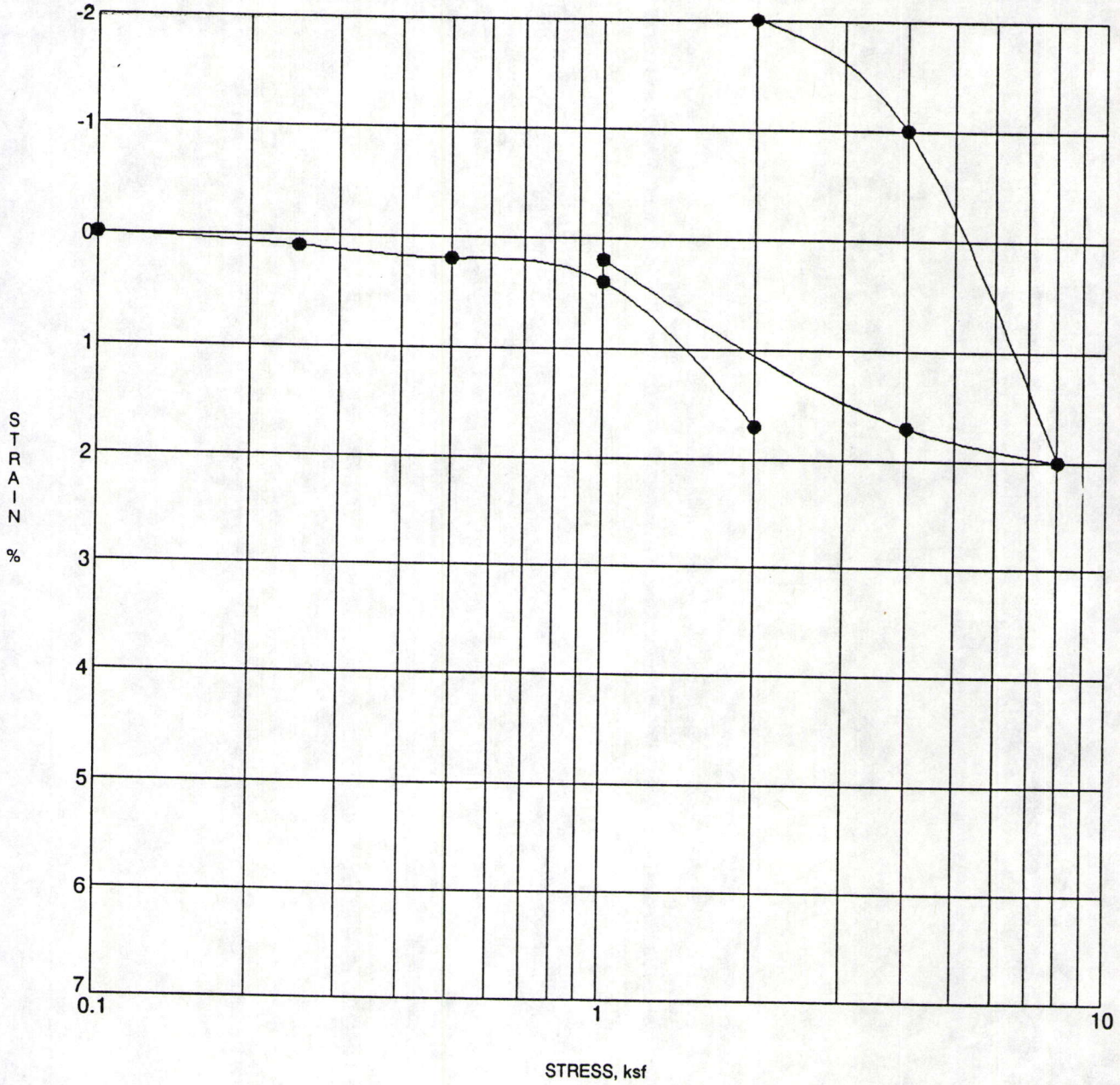

Specimen Identification	Classification	DD	MC%
● CBTP-4		75	32

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **8**

CONSOLIDATION TEST

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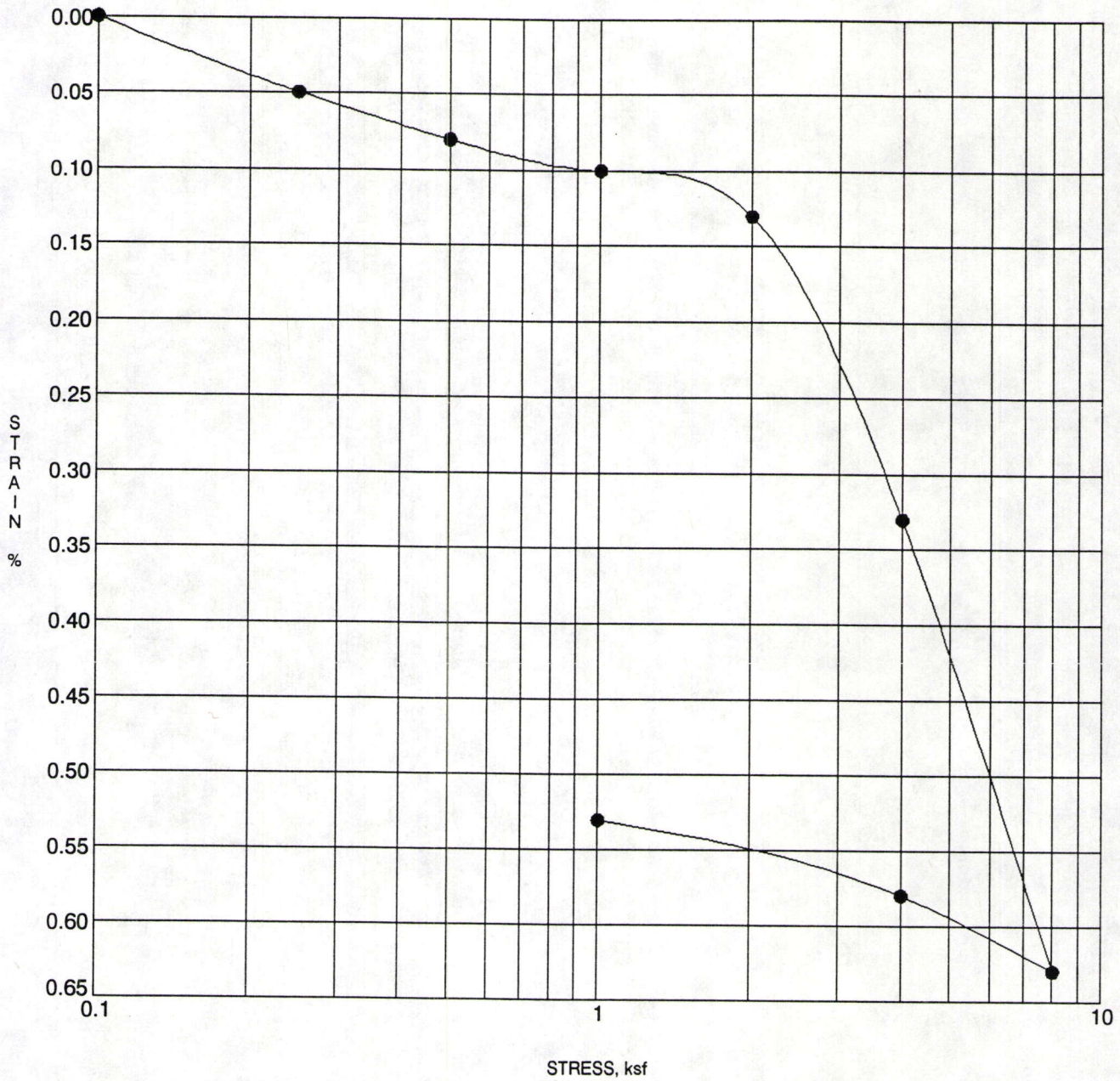


Note: Water added at 2 ksf

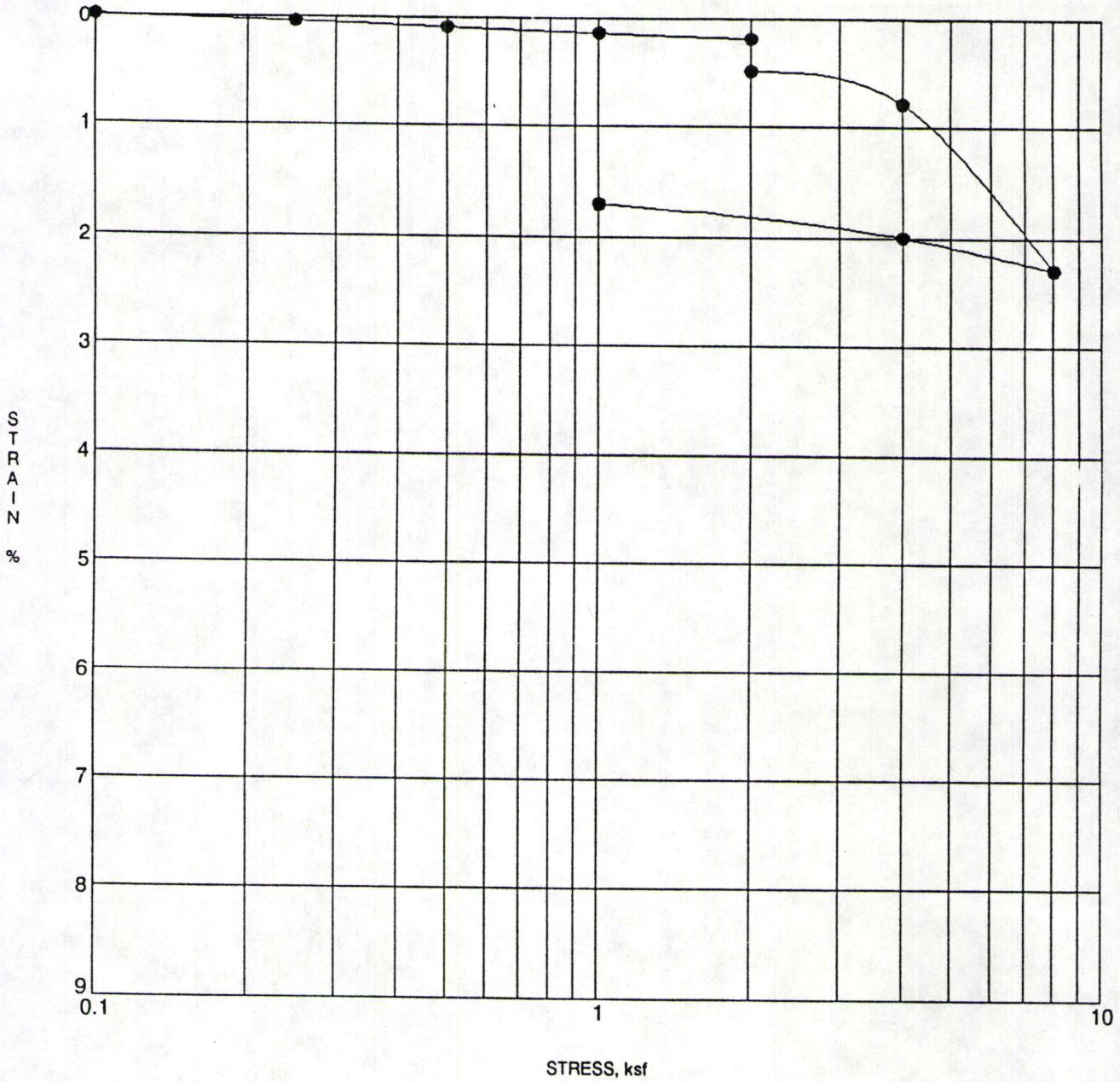
	Specimen Identification		Classification	DD	MC%
●	TP-14	2.0		124	9

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **1**

CONSOLIDATION TEST



	Specimen Identification	Classification	DD	MC%
●	TP-15		103	9

PROJECT Drum Mine

JOB NO. 5-254-91

FIGURE NO. 2

CONSOLIDATION TEST

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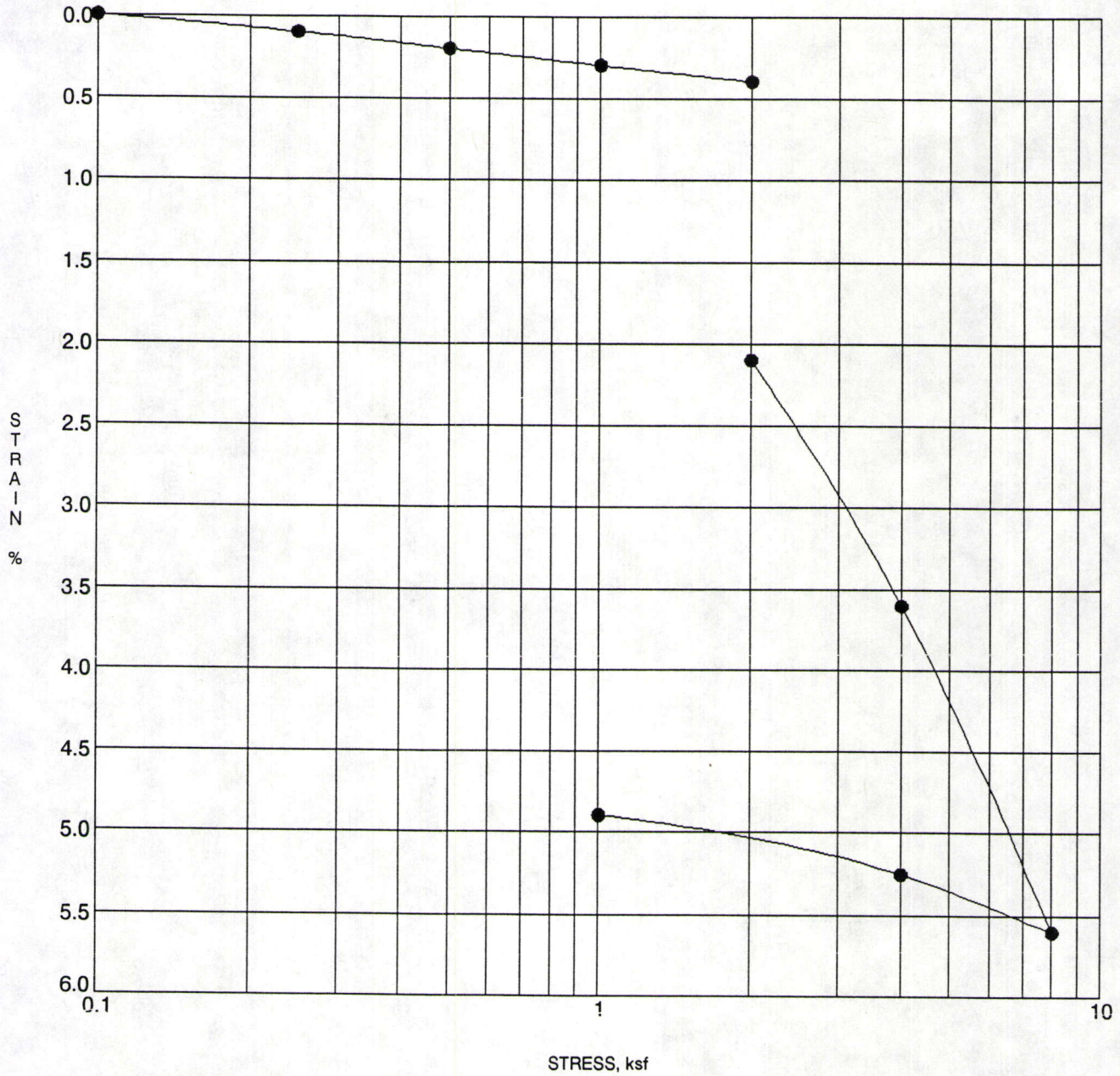


Note: Water added at 2 ksf

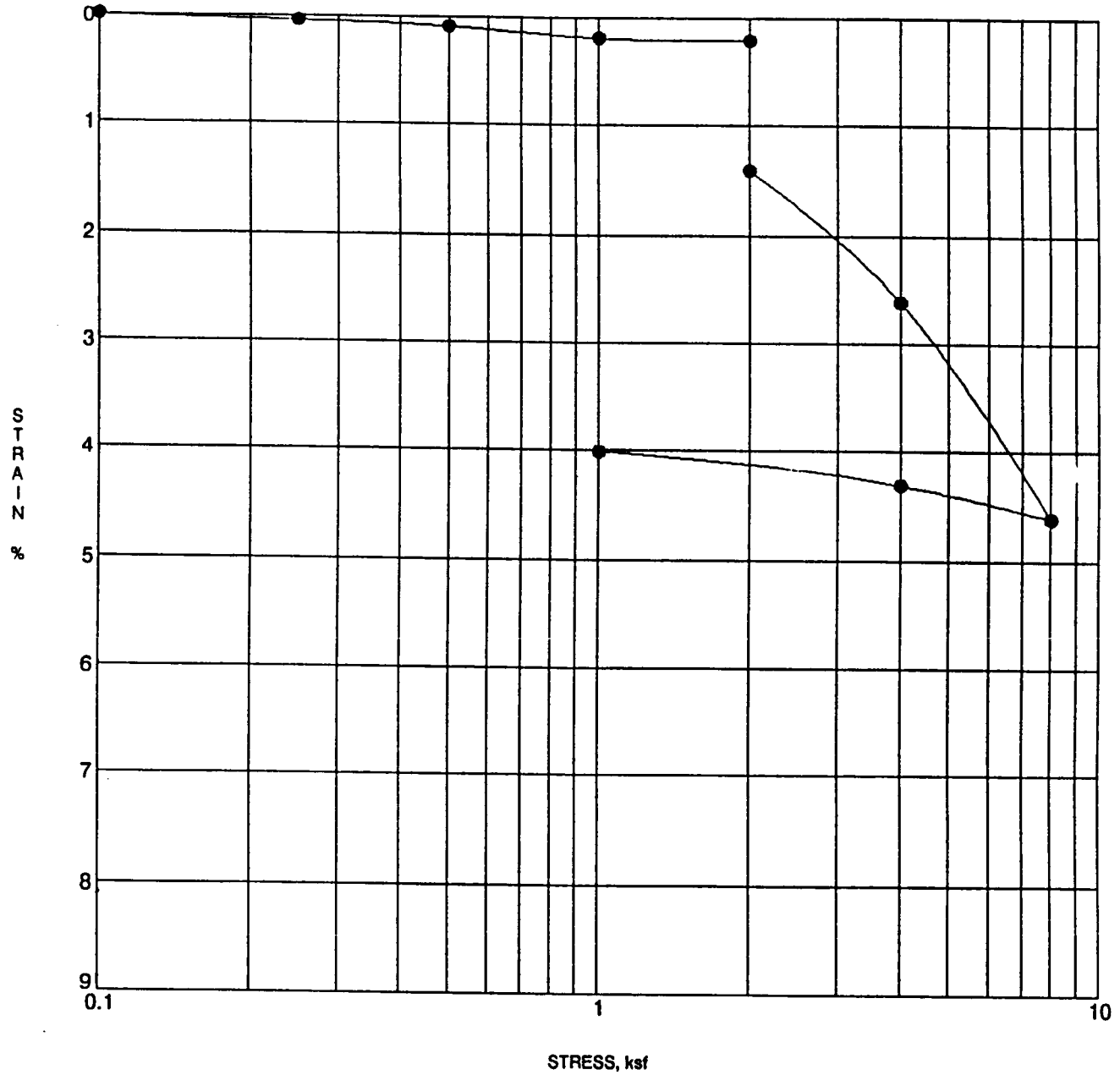
	Specimen Identification		Classification	DD	MC%
●	TP-16	2.0		111	10

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **2**

CONSOLIDATION TEST



Specimen Identification		Classification	DD	MC%
●	TP-18		115	11

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **4**

CONSOLIDATION TEST

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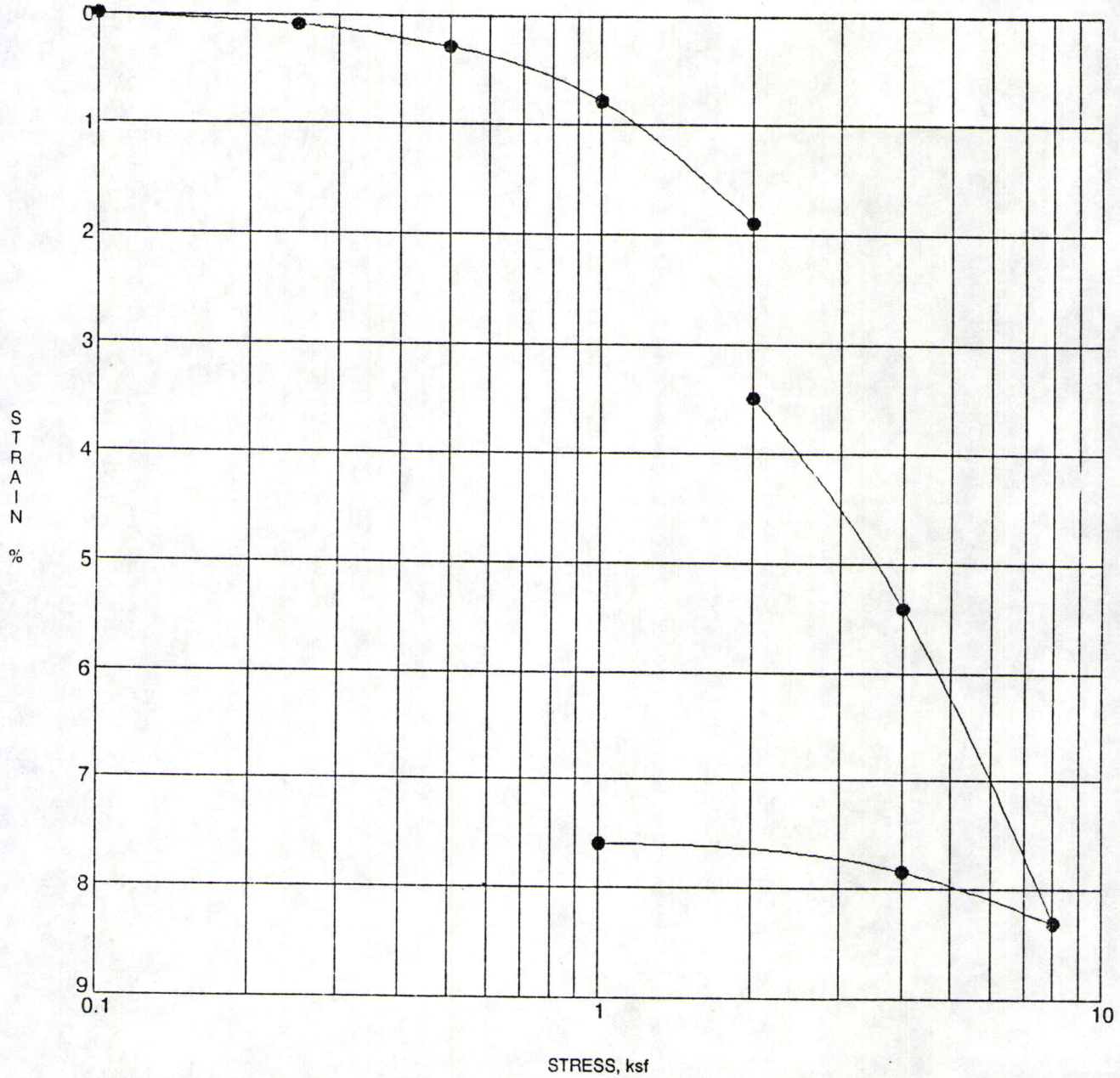

Specimen Identification	Classification	DD	MC%
● TP-20		111	10

PROJECT Drum Mine

JOB NO. 5-254-91

FIGURE NO. 5

CONSOLIDATION TEST

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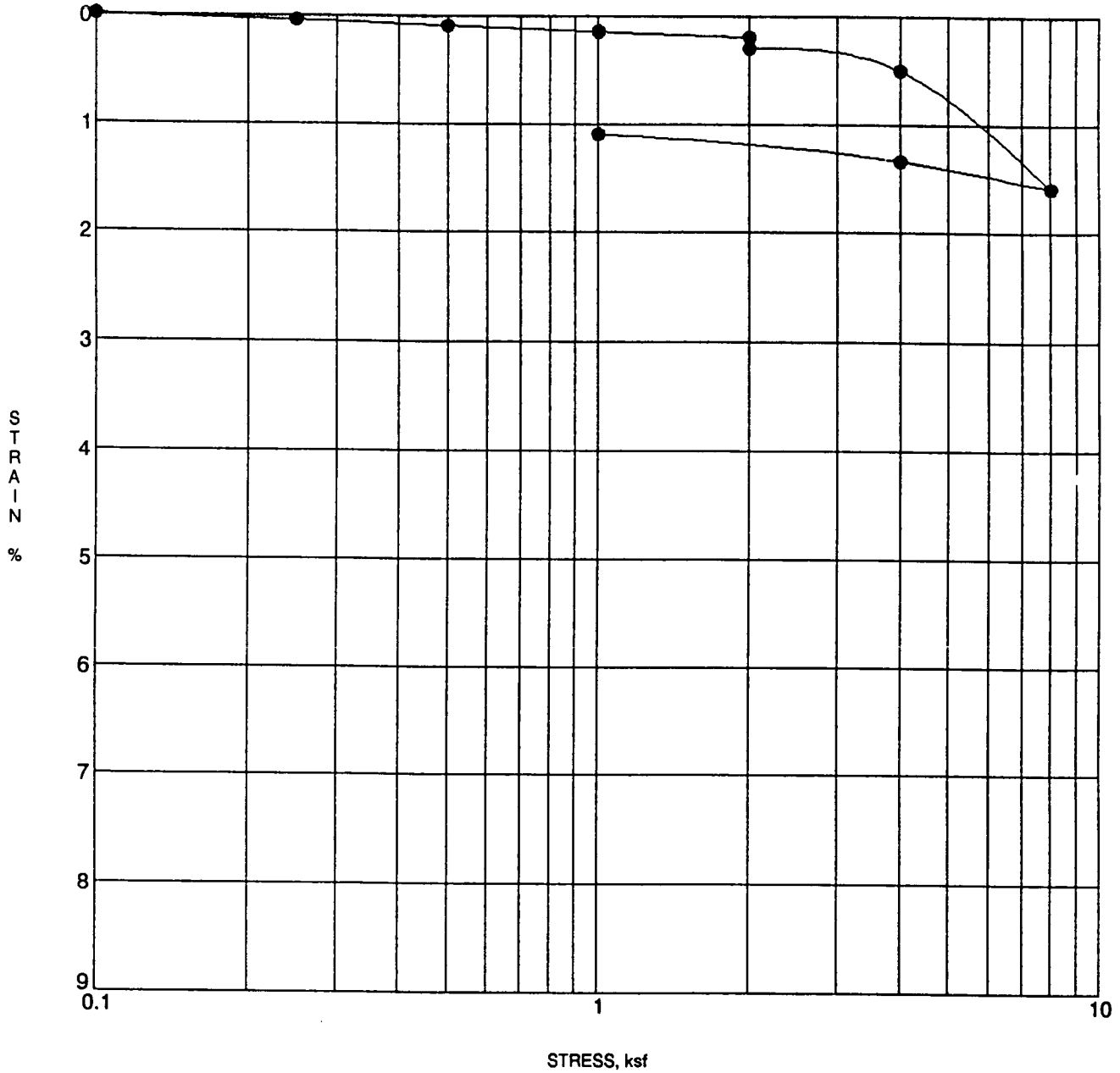

	Specimen Identification	Classification	DD	MC%
●	TP-21		108	12

PROJECT **Drum Mine**

JOB NO. **5-254-91**

FIGURE NO. **6**

CONSOLIDATION TEST

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This page is a reference page used to track documents internally for the Division of Oil, Gas and Mining

Mine Permit Number M0270007 Mine Name Drum Mine
Operator Western States Minerals Date June 12, 1991
TO _____ FROM _____

__CONFIDENTIAL __BOND CLOSURE __LARGE MAPS X EXPANDABLE
__MULTIPUL DOCUMENT TRACKING SHEET __NEW APPROVED NOI
__AMENDMENT _OTHER _____

Description YEAR-Record Number

__NOI X Incoming __Outgoing __Internal __Superceded
Engineering Services Report
Feasibility Analysis
H-10 Heap Leach Pad

___NOI __Incoming __Outgoing __Internal __Superceded

__NOI __Incoming __Outgoing __Internal __Superceded

__NOI __Incoming __Outgoing __Internal __Superceded

__TEXT/ 81/2 X 11 MAP PAGES __11 X 17 MAPS __LARGE MAP

COMMENTS: _____

CC: _____